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10/540,732	07/25/2005	Poopathy Kathirgamanathan	LUC-015	9084

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EXAMINER
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YAMNITZKY, MARIE ROSE

ART UNIT	PAPER NUMBER
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1786

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07/20/2010

PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/540,732	<b>Applicant(s)</b> KATHIRGAMANATHAN ET AL.	
	<b>Examiner</b> Marie R. Yamnitzky	<b>Art Unit</b> 1786	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 07 May 2010.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 71-90 is/are pending in the application.
- 4a) Of the above claim(s) 71-76 and 81-85 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 77-80 and 86-90 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |   |   |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)                    | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____                                      |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)         | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____   | 6) <input type="checkbox"/> Other: _____                          |

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1. This Office action is in response to applicant's amendment filed May 07, 2010, which amends the specification and claims 77, 78 and 86.

Claims 71-90 are pending.

2. Claims 71-76 and 81-85 stand withdrawn from consideration as being directed to a non-elected invention. Election was by original presentation. See 37 CFR 1.142(b) and MPEP § 821.03.

Withdrawn process claims will be considered for rejoinder if/when a product claim is found to be allowable. See MPEP 821.04(b) for the conditions necessary for rejoinder of withdrawn process claims.

3. The objection to the disclosure for informalities as set forth in the Office action mailed February 04, 2010 is overcome by amendment.

The rejection under 35 U.S.C. 112, 2<sup>nd</sup> paragraph, is partly overcome by amendment. Remaining issues are set forth below.

4. Claims 77-80 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

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The scope of the variables  $R_1$  to  $R_4$  per claim 77 and dependents is unclear because it is not clear if/how “aromatic and heterocyclic carboxy groups” as recited in dependent claim 78 are within the scope of the possibilities recited in independent claim 77.

The scope of aromatic and heterocyclic carboxy groups as recited in claim 78 is not clear. Although this terminology is used in the specification, no specific examples of such groups are provided that might clarify the scope. It is not clear if this claim language refers to carboxy groups that are substituted with an aromatic or heterocyclic ring, with an oxygen of the “oxy” group being bonded to the carbon to which the R variable is attached per the formula.

It is not clear if aromatic and heterocyclic carboxy groups are intended to be within the scope of substituted aromatic, heterocyclic and polycyclic ring structures as recited in claim 77.

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 77, 78 and 86-90 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsuboyama et al. (US 2003/0152802 A1) in view of Lamansky et al. (US 2002/0182441 A1), Tsuboyama et al. (US 2003/0068536 A1), and Yamazaki (*Trends in Inorganic Chemistry*, Vol. 1, 1990, pp. 75-84).

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See the entire Tsuboyama '802 patent application publication. In particular, see Fig. 1A-1D, paragraphs [0001]-[0005], [0008]-[0009], [0015], [0027]-[0035], [0037] and [0065] (especially formulae 15, 20-26, 31 and 32 on pages 7-8 ), and compound Nos. 211-217, 222, 223 and 269 as defined in Tables 5 and 6 (pp. 10-11). Tsuboyama's metal coordination compounds are disclosed for use in the luminescence layer of an organic luminescence device comprising a luminescence layer positioned between an anode and a cathode.

Each of Tsuboyama's metal coordination compound Nos. 211-217, 222, 223 and 269 is an electroluminescent iridium compound similar to compounds having the general chemical formula set forth in present claims 77 and 86. These prior art compounds do not meet the definition of R<sub>1</sub> to R<sub>4</sub> as defined in the present claims because each of these compounds has a methyl group at the positions corresponding to present R<sub>1</sub> to R<sub>4</sub>.

Tsuboyama's compound No. 211 is essentially two molecules of Ir(ppy)<sub>2</sub>acac linked together by a single bond connecting the acac (acetylacetonate) ligand of each of the two molecules, and compounds such as Nos. 212-217 are substituted derivatives thereof wherein the phenylpyridine ligands have a substituent on each phenylpyridine ligand. While Tsuboyama '802 does not disclose complexes in which two diketone ligands other than acac form the quadridentate ligand, other diketone ligands that could be used in place of acac were known in the art at the time of the invention as evidenced by Lamansky et al. and Tsuboyama et al. ('536), and methods to link two diketone ligands together at the position required to form the quadridentate ligand of the present compounds were known as evidenced by Yamazaki.

For example, Lamansky et al. teach that diketone ligands having phenyl groups may be used for the same purpose as acac (a diketone ligand having methyl groups); see the first and sixth formulae in Lamansky's Figure 6c. These ligands are taught as suitable for making electroluminescent compounds, which may be iridium compounds.

In Tsuboyama '536, see formula (4) in claim 1. When each of E and G is a methyl group (an alkyl group having 1 carbon atom), the ligand of formula (4) is acac. E and G may be linear or branched alkyl groups having 1 to 20 carbon atoms in which a hydrogen can optionally be replaced by a fluorine atom, and aromatic groups capable of having a substituent as set forth in claim 1 of Tsuboyama '536. Groups such as substituted aliphatic groups, and substituted and unsubstituted aromatic groups, are within the scope of E and G for the formula (4) structure as defined in Tsuboyama '536. The formula (4) structure is part of an electroluminescent compound, which may be an iridium compound.

One of ordinary skill in the art at the time of the invention, having knowledge of the teachings of Tsuboyama '802, would have been motivated to make similar compounds with the expectation that compounds that are similar in structure would be electroluminescent and could be used in a device as taught in the '802 reference. One of ordinary skill in the art at the time of the invention, having knowledge of the teachings of Lamansky et al. and Tsuboyama '536, would have reasonably expected that quadridentate ligands provided by two linked diketone ligands selected from diketone ligands known in the art to be suitable for electroluminescent compounds, could be used in place of the quadridentate ligand of formula 15 used in Tsuboyama '536.

With respect to the recitation in present claim 77 that the electroluminescent layer comprising the iridium compound is deposited by vacuum evaporation, product-by-process claims are not limited to the process steps recited, only to the structure implied by the steps. Given the teachings of the prior art references as a whole, it is the examiner's position that it would be obvious to one of ordinary skill in the art at the time of the invention to make compounds similar to compound Nos. 211-217, 222, 223 and 269 of Tsuboyama '802 having other ketone linking ligands, such as those derived by linking two diketone ligands having the alternative structures disclosed by Lamansky et al. or Tsuboyama '536, and to use such compounds to form an electroluminescent layer between a pair of electrodes.

Further, with respect to claim 77's recitation of vacuum evaporation, and the recitation in claim 86 of a compound "capable of being vacuum-evaporated onto a substrate for use as an electroluminescent layer", it is the examiner's position that it is reasonable to expect that Tsuboyama's compound Nos. 211-217, 222, 223 and 269 inherently are capable of being vacuum evaporated and that similar compounds having other ketone linking ligands would also inherently have this capability. Tsuboyama's compounds are taught for use in an electroluminescent layer, and vacuum deposition is utilized in some of Tsuboyama's device examples. Although Tsuboyama does not provide a device example in which one of compound Nos. 211-217, 222, 223 and 269 is vacuum deposited, it is reasonable to expect that any of these compounds is capable of being vacuum deposited. Further, Tsuboyama's compound No. 211 is applicant's compound of Example 3, which is capable of being vacuum-evaporated onto a substrate for use as an electroluminescent layer.

With respect to claim 89, one of ordinary skill in the art at the time of the invention would reasonably expect that compounds similar to at least Tsuboyama's compound Nos. 211-216 and 269, but having different ketone linking ligands, would inherently be capable of exhibiting green electroluminescence because the substituted and unsubstituted phenylpyridine ligands of these compounds would be expected to be the ligands most affecting the color of light emission, and green emission would be expected from these substituted and unsubstituted phenylpyridine ligands.

7. Claims 79 and 80 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsuboyama et al. (US 2003/0152802 A1) in view of Lamansky et al. (US 2002/0182441 A1), Tsuboyama et al. (US 2003/0068536 A1), and Yamazaki (*Trends in Inorganic Chemistry*, Vol. 1, 1990, pp. 75-84) as applied to claims 77, 78 and 86-90 above, and further in view of Kathirgamanathan (WO 98/58037).

Tsuboyama '802 does not disclose mixing an iridium compound with an electroluminescent europium complex in a single electroluminescent layer, or using two electroluminescent layers, one containing an iridium compound and the other containing an europium complex. Electroluminescent europium complexes within the scope of those required for present claims 79 and 80 were known in the art at the time of the invention.

Kathirgamanathan discloses such europium complexes. For example, see Examples 6-10 on pages 9-13 of WO '037. The europium complex required by present claim 80 is the complex of Example 6 in WO '037. Further, it was known in the art at the time of the invention that more



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than one light-emitting material could be used in combination so as to alter the color of light emitted by the device. For example, Kathirgamanathan teaches on page 6 that mixtures of electroluminescent metal complexes can be used to modify the color of emitted light. Absent a showing of unexpected results commensurate in scope with present claims 79 and 80, it is the examiner's position that it would have been a *prima facie* obvious modification to one of ordinary skill in the art at the time of the invention to use combinations of electroluminescent materials, such as iridium compounds similar to those of Tsuboyama '802 (including those having different ketone linking ligands) and the europium complexes taught by Kathirgamanathan, in the luminescence layer of an EL device.

8. Applicant's arguments filed May 07, 2010 have been fully considered but they are not persuasive.

The rejection of claims 86-90 under 35 U.S.C. 112, 2<sup>nd</sup> paragraph, is overcome by the amendment to claim 87 as set forth in the amendment filed May 07, 2010. The rejection of claims 77-80 is not overcome because claim 78 continues to recite "aromatic and heterocyclic carboxy groups".

The rejections under 35 U.S.C. 103(a) are not overcome by amendment. Although the rejected claims have been narrowed, it is the examiner's position that some embodiments within the scope of the claims would have been obvious to one of ordinary skill in the art at the time of the invention given the applied art.

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Applicant argues that none of the applied references alone discloses a compound within the scope of claims 86-90, or a diiridium compound as required for the device of claims 77-80. The examiner agrees. If any of the references alone did disclose such a compound, the issue would be one of anticipation (for at least some of the claims) rather than obviousness. One cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

Applicant further argues that an argument based on chemical structural similarity loses validity as the chemical structures involved become more complex. Applicant argues that the diiridium compounds claimed in claim 86 and dependents, and required for the device of claim 77 and dependents, are very large, complex and sophisticated chemical structures. Applicant argues that the cited literature does not suggest that the claimed chemical structures even stably exist, and do not suggest how to prepare such compounds or what properties they might exhibit. Applicant further argues that the cited literature does not suggest that the large, awkward molecular structures of the claimed compounds would survive a high-temperature vacuum-evaporation synthesis/device fabrication step.

The formula defined in present claims 77 and 86 encompasses iridium compounds that are very similar in chemical structure to Tsuboyama's compound Nos. 211-217, 222, 223 and 269. Each of these compounds meets the limitations of L<sub>1</sub> and L<sub>2</sub> of the present formula, but does not meet the limitations of R<sub>1</sub>-R<sub>4</sub> as required for claims 77, 86 and dependents.

Tsuboyama's compound Nos. 211-217, 222, 223 and 269 have a methyl group at the positions

corresponding to present R<sub>1</sub>-R<sub>4</sub>. While the rejected claims do not encompass compounds of the formula wherein R<sub>1</sub>-R<sub>4</sub> is a methyl group, they do encompass compounds similar in structure, such as compounds wherein each of R<sub>1</sub>-R<sub>4</sub> is a substituted methyl group or a substituted derivative of an alkyl group other than a methyl group. Substituted alkyl groups, such as a substituted methyl group, are substituted aliphatic groups. For iridium compounds having a diketone ligand (essentially, compounds represented by half the formula shown in claims 77 and 86), Tsuboyama '536 teaches alkyl groups having 1 to 20 carbon atoms and substituted derivatives thereof having hydrogen replaced by fluorine at the positions corresponding to R<sub>1</sub> and R<sub>3</sub> (or R<sub>2</sub> and R<sub>4</sub>). Substituted derivatives of alkyl groups having 1 to 20 carbon atoms and having hydrogen replaced by fluorine are within the scope of substituted aliphatic groups represented by present R<sub>1</sub>-R<sub>4</sub>. Based on Tsuboyama '536, one would reasonably expect that using a quadridentate ligand similar in chemical structure to formula (15) of Tsuboyama '802 but having a substituted derivative of an alkyl group having 1 to 20 carbon atoms in place of each methyl group (a methyl group being an unsubstituted alkyl group having 1 carbon atom) would provide electroluminescent compounds since both Tsuboyama references are directed to electroluminescent compounds.

Tsuboyama '536 also teach that substituted and unsubstituted aromatic groups, such as a phenyl group, may be present in place of alkyl groups at the corresponding positions of a diketone ligand. Lamansky '441 also discloses iridium compounds that are electroluminescent compounds and that have a diketone ligand (as with Tsuboyama '536, compounds represented by half the formula shown in claims 77 and 86) with methyl groups or phenyl groups at the

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positions corresponding to R<sub>1</sub> and R<sub>3</sub> (or R<sub>2</sub> and R<sub>4</sub>). Based on Tsuboyama '536 or Lamansky '441, one would reasonably expect that using a quadridentate ligand similar in chemical structure to formula (15) of Tsuboyama '802 but having an aromatic group such as a phenyl group in place of each methyl group would provide electroluminescent compounds since each of these references is directed to electroluminescent compounds.

Applicant also argues that there is no motivation, other than impermissible hindsight, to prepare the present compounds. Applicant argues that Tsuboyama '802 does not suggest a problem with Tsuboyama's compounds, and therefore there is no motivation to embark on a fishing expedition for additional useful compounds.

In response to applicant's argument that the examiner's conclusion of obviousness is based upon improper hindsight reasoning, it must be recognized that any judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the applicant's disclosure, such a reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA 1971).

A prior art reference that discloses a compound need not disclose a problem with the compound in order for one of ordinary skill in the art to be motivated to make additional compounds that are similar in structure that could be used for the same purpose. In fact, one might argue that if the prior art disclosed a problem with a certain compound and did not suggest any possible "fixes" for alleviating the problem, one would have no motivation to provide

similar compounds because similar compounds would be expected to have the same problem.

That is not the case in this situation. Tsuboyama '802 discloses iridium compounds that are useful in an electroluminescent layer of an electroluminescent device comprising the electroluminescent layer disposed between a pair of electrodes, including compounds that are similar in structure to compounds represented by the formula in present claims 77 and 86.

Tsuboyama '802 is not limited to the compounds defined in the Tables disclosed, and is not limited to the specific quadridentate ligands depicted in paragraph [0065]. One of ordinary skill in the art, having Tsuboyama's disclosure of a quadridentate ligand that is a tetraketone ligand corresponding in structure to two directly linked diketone ligands known in the art at the time of the invention to be useful for making electroluminescent iridium compounds, and having knowledge of other diketone ligands known in the art at the time of the invention to be useful for making electroluminescent iridium compounds (such as disclosed in Lamansky '441 or Tsuboyama '536), would have reasonably expected that other tetraketone ligands similar to the ligand represented by formula (15) in Tsuboyama '802 could be used to make other electroluminescent iridium compounds that would be useful for the purposes taught in Tsuboyama '802.

The examiner notes that there is no evidence of record to demonstrate that compounds represented by the formula set forth in present claims 77 and 86 provide unexpected results compared to Tsuboyama's compound Nos. 211-217, 222, 223 and 269. The only specific compound exemplified in the original disclosure of the present application is Tsuboyama's compound No. 211. No specific examples of compounds within the scope of present claims 86-

90 and within the scope of the iridium compound required for the device of present claims 77-80 are disclosed in the present application.

Applicant also argues that none of the prior art of record teaches the method of making the compounds of claim 86 or compounds required for the device of claim 77, particularly the vacuum-evaporation synthesis/device fabrication step. Applicant argues that there is no basis in the applied references to extrapolate the disclosure of Tsuboyama '802 regarding vacuum evaporation to conclude that it is reasonable to expect the compounds of Tsuboyama '802 that have the diketone bridging ligand are vacuum-evaporatable. Applicant argues that the examiner's reference to Example 3 in the present specification (with reference to capability to be vacuum-evaporated) indicates that the entire rejection is based on improper hindsight.

Example 3 provides evidence of inherency with respect to the capability of Tsuboyama's compound No. 211 to be vacuum-evaporated. It is permissible for the examiner to refer to applicant's disclosure for evidence of inherency of a specified property in a particular compound disclosed in the prior art. Use of applicant's disclosure in this regard is not using applicant's disclosure as prior art. A compound disclosed in the prior art that is the same as a compound disclosed in the present disclosure must inherently possess the same properties since it is the same compound. Further, applicant's reliance on vacuum evaporation as a patentable distinction with respect to the presently claimed device and compound is misplaced because vacuum evaporation is a process whereas the rejected claims are directed to products. Even if one of ordinary skill in the art would not expect Tsuboyama's compound Nos. 211-217, 222, 223 and 269 and similar compounds having substituted aliphatic groups or groups such as phenyl groups

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in place of the methyl groups in the quadridentate ligand of these compounds to be capable of being vacuum-evaporated onto a substrate for use in an electroluminescent layer (and the examiner does not concede that this is the case), one would still be motivated to make the similar compounds and use them in the electroluminescent layer of an electroluminescent device with the expectation that the similar compounds would be electroluminescent compounds.

9. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

10. Any inquiry concerning this communication should be directed to Marie R. Yamnitzky at telephone number (571) 272-1531. The examiner works a flexible schedule but can generally be reached at this number from 7:00 a.m. to 3:30 p.m. Monday and Wednesday-Friday.

The current fax number for all official faxes is (571) 273-8300. (Unofficial faxes to be sent directly to examiner Yamnitzky can be sent to (571) 273-1531.)

/Marie R. Yamnitzky/  
Primary Examiner, Art Unit 1786

MRY  
July 16, 2010